

Independent Report

NWFSC Southern California Shelf Rockfish Hook and Line Survey

Seattle, Washington. April 4-5, 2012

Mark Wilkins

NOAA, NMFS, AFSC (Retired)

Executive Summary

My review of the NWFSC's Southern California Shelf Rockfish Hook and Line Survey found that this survey was well designed, has been conducted successfully for eight years, and the results have been useful for several Pacific Fishery Management Council (PFMC) stock assessments. This is an index survey and its design was refined over the first 3-4 survey years. The design and most of the assumptions behind it appear sound and the results from it have yielded sensible results over the course of prosecuting it. One of the primary assumptions of index surveys is that the set of sampling sites, as a whole, represents the habitat of the resources being assessed. In the case of this survey, this assumption would benefit from some degree of verification, particularly with regard to the depth range being sampled vs the depth range of the targeted species and with regard to the effects of not being able to sample within the Cowcod Conservation Areas (CCAs), which have been instituted under PFMC regulations to conserve threatened species. I suggest experiments to examine the representativeness assumption. A random element of the initial survey design was abandoned after 3-4 years since the problems it was designed to solve did not seem to be problems, after all. I agree with that change and see no need to include a random component to the sampling design.

The choice of survey gear is sound, having been made under joint consultation with industry representatives very familiar with the region and its resources. It has been thoroughly standardized and the protocols of the gear and how to fish it have been rigorously standardized. I have pointed out a couple of aspects of the fishing protocol that could potentially introduce bias. Currently, anglers tend to stay at a favorite sampling station along the rail. By rotating the position of the anglers among the 3 sampling stations along the rail via random or regular rotation any potential bias due to angler expertise at a particular position could be easily

removed. And the decision whether to re-use bait or to re-bait a hook should be standardized among anglers; it is currently left for the individual angler to make that decision. Biological sampling protocols appear thorough, sound, and well standardized.

I acknowledge that knowledge regarding the analytical methods of a model-based analysis is not my forte. The two analytical issues of most concern to me had to do with the uncertainty around the assumption of the representativeness of the sampling sites and the fact that some of the 20 sampling/analysis areas contain only a single sampling site while others contain as many as 10. Another issue which I believe bears further consideration is the potential for interspecific hook competition to obscure or mask the changes in relative abundance among two or more species at a given site. During the review the other reviewers brought up a number of concerns, some of which I don't fully understand the implications of. I support two of their concerns, however. The idea of stratifying the set of 20 areas using clustering techniques to boil down the results into 4 or 5 clusters of areas exhibiting similar characteristics appears to be a good idea for helping simplify interpretation of the survey results. Also, employing more parsimony about selecting which variables to include in the model(s), using only those variables that one can make sense of their physical consequences, makes sense to me.

With regard to the utility of the results of this survey toward assessing the less consistently encountered species, I feel that it is of limited use in assessing abundance of these species but is a good, sound source of biological information. I endorse expansion of this survey into two classes of habitat in the SCB – deeper waters than the current maximum sampling depth of 125 fm and into the waters closed by CCAs. This can be done either experimentally or on a “production” basis and would answer questions about whether or not the current sampling sites adequately represent the habitat of the stocks being assessed. A number of important issues need to be considered when considering expanding this type of survey into other areas along the coast including the need for an additional survey index, what information is most critically required, the mix of species within the area, how many of those species are vulnerable to this type of sampling gear, as well as how realistic is it to expect to effectively sample the area (vulnerability to weather, proximity to ports, etc.).

Background

The stated overall goal of the April 4-5 CIE Review of the Northwest Fisheries Science Center's (NWFSC) Southern California Shelf Rockfish Hook and Line Survey was “... to evaluate whether the design, protocols, and analytical methods developed for the NWFSC's hook and line survey are suitable for achieving the survey's objectives. The survey's primary objective is to generate information for use in stock assessments of structure-associated rockfish, particularly those species which are poorly sampled by trawl gear used in coast-wide surveys. Such information includes fishery-independent indices of abundance as well as biological data

on size, age and maturity.” The rockfish species primarily focused upon by this survey include large shelf rockfish (Genus *Sebastes*) including bocaccio (*S. paucispinis*), the vermilion rockfish complex, which includes vermilion rockfish (*S. miniatus*) and sunset rockfish (*S. crocotulus*) and greenspotted rockfish (*S. chlorostictus*).

In addition to two reviewers from the Center for Independent Experts (CIE), two local reviewers were invited to participate in the review. I am one of the two local reviewers and, because the other local reviewer (and designated chair of the review panel) was unable to participate, I served as the review panel chair for the meeting. Each reviewer was tasked with conducting an impartial and independent peer review in accordance with the Statement of Work and Review Workshop Terms of Reference (ToRs; Annex 2). The specific goals of the review meeting were to: 1) evaluate the hook and line survey’s design and protocols; 2) examine the analytical methods used to generate abundance indices; and, 3) provide suggestions regarding potential expansion of the survey’s geographical range and species for which abundance indices are generated - particularly for data-poor and data-limited species.

The agenda of the Review Panel meeting is attached in Annex 3. The Review Panel was composed of a Chair and two CIE reviewers. The CIE reviewers were independent and had working knowledge and recent experience in the application of fish population dynamics, stock assessment methods, and fishery survey design. The Review Panel was instructed to submit only individual reports and to not compile or submit a consensus report.

Role of Reviewer

I attended the NWFSC Southern California Shelf Rockfish Hook and Line Survey meeting in Seattle, Washington during April 4-5, 2012. I reviewed presentations and reports and participated in the discussion of these documents, in accordance with the SoW and ToRs (see Appendix 2). This report is structured according to my interpretation of the required format and content described in Annex 1 of Appendix 2.

I reviewed the background documents I was provided. These are listed in Appendix 1 and provided a thorough background on the primary target stocks of this survey, the need to develop an additional means of surveying these stocks, the process of developing this hook and line survey and the analytical methods used to interpret the survey results, and how the findings of the survey are being used in the stock assessments of rockfish species in California, in particular those for the target species: bocaccio, the vermilion rockfish complex (with sunset rockfish), and greenspotted rockfish.

Summary of findings

In contrast to most other CIE reviews, this Review Panel was asked to submit only independent review reports and was instructed to not compile or submit a Panel Summary Report. Therefore, statements and opinions in this report reflect my thoughts only and, unless specifically stated, do not reflect those of the other reviewers, Drs. Noel Cadigan and Sven Kupschus.

ToR 1: The overall goal of this review is to evaluate whether the design, protocols, and analytical methods developed for the NWFSC's hook and line survey are suitable for achieving the survey's objectives. The survey's primary objective is to generate information for use in stock assessments of structure-associated rockfish, particularly those species which are poorly sampled by trawl gear used in coast-wide surveys. Such information includes fishery-independent indices of abundance as well as biological data on size, age and maturity.

The presentation team did a commendable job of explaining to the review panel the objectives and priorities of the review and of setting the stage for a productive, effective session. All questions and concerns of the reviewers were thoughtfully and thoroughly addressed by the team, including additional analyses requested for clarification and exploration of data and analytical methods. I left the final session of the review feeling that I had all the information I needed to compile my thoughts about the survey.

ToR 2: Review recent literature (to be provided as background materials) to become familiar with the key species and the primary science and management issues within the Pacific Fishery Management Council (PFMC) umbrella for groundfish in general and structure-associated shelf rockfish in particular.

A very comprehensive collection of documents was provided the reviewers well in advance of the review itself, giving us ample time to familiarize ourselves with the background of the region, the PFMC process, and the rockfish species that inhabit this region. The literature provided a good history of the stocks involved, the need for additional methods to survey the resources in question, the development of the survey design, the course of implementing the pilot survey and refinements made to the design, the methods developed to analyze results, and examples of how the results of the survey have been used in subsequent assessments of target species stocks, as well as other stocks in the region. I felt that I had all the information necessary to prepare for the task at hand and it was my sense that the other reviewers also felt adequately prepared.

ToR 3: Evaluate the suitability of the survey sampling design. Specifically, is the design appropriate for generating abundance indices for shelf rockfish species? Comment on the benefits and drawbacks of the current fixed-site design. Are there benefits to replace or modify the survey's existing fixed-site design with one that includes a random component? If so, do the benefits outweigh the drawbacks associated with disrupting the continuity of the survey's current 8-year time series?

The design of this survey evolved from including fixed as well as random sites to eliminating the random component and settling on using a set of 121 fixed sites in 20 sampling areas. The design is essentially an index area survey that relies on the assumption that the 121 sites, while they need not be randomly selected, must adequately represent the universe of sites covering the habitat of structure-associated shelf rockfish (primarily designed for the habitat range of bocaccio) habitat in the Southern California Bight (SCB). Consequently, the survey will benefit from the advantages of index surveys and suffer from the limitations of index surveys. One of the strongest advantages of using an index survey approach is that it revisits the same areas each time and that the areas don't need to account for the entire habitat area of the resource. This entails assuming that the index sites represent other similar areas in the region which are not sampled. These two characteristics make index surveys economical and efficient. Limitations include the possibility of missing portions of the stock during the survey that may be exhibiting population changes or characteristics different from the part of the stock that is available at the survey sites. The chance of this happening in this survey may be small, but two factors make this an area of concern for me. First, the depth range of the survey (20-125 fm) does not really cover the entire depth range of bocaccio. Secondly, conservation areas for cowcod, another rockfish species, exist within the SCB and fishing or even survey sampling within the Cowcod Conservation Areas (CCAs) is prohibited.

The depth distribution of bocaccio is somewhat deeper than for many other species of shelf rockfish. Their maximum depth extends out to at least 150-175 fm off some parts of the California coast. The maximum sampling depth of this survey is 125 fm. During the presentation, it was stated that the survey maximum depth was “an *approximation* of the *common* depth range of bocaccio described in Love et al. 2002” (my emphasis) and that 125 fm was approaching the effective practical limit for the fishing depth of the hook and line sampling gear. During discussions it seemed that the effective sampling depth limitation was the operative limitation governing the choice of 125 fm as a maximum survey depth, although the team and the fishing skippers, who were also present during the review, felt that the fishing gear could probably sample “a little bit deeper” without suffering any drop in effectiveness. The survey is likely covering the entire depth range of some of the target species and most of the depth range of bocaccio, but I suggest that some experimental fishing should be done in deeper waters to more examine what portion of the population of these species the survey might be missing due to the present maximum sampling depth.

While conservation of species like cowcod that are “on the ropes” is obviously necessary, some measures taken to protect these species have the unfortunate consequence of hamstringing scientists that need to assess other stocks that reside in the same habitats. This is a common dilemma along the Pacific coast of the US, particularly as regards the *Sebastes* genus. By closing large areas of the SCB with CCAs, it effectively plunges assessment scientists into darkness; they are unable to conduct sampling to determine how stocks of cowcod and other species present in these areas are changing. In some cases, very limited sampling with an eye toward minimizing impacts on the stressed species should probably be considered. Could this be one of those cases? Can the methods of this hook and line survey be used, even in some minimal extent, within the CCAs to determine whether the stock(s) within them are in different shape than those outside them? It is an approach that the survey team should consider, perhaps initially as an experiment to see what insight a year or two of data from within CCAs might offer. Discussion about this topic during the review included the practicality of sampling within CCAs and releasing cowcod after re-pressurizing them using portable barometric chambers (NMFS’s Auke Bay Laboratories has developed such equipment) or puncturing their air bladders (NOT recommended!) to mitigate impacts of catch-and-releasing them. Team members familiar with the resources felt confident that catch rates of most rockfish species would be higher, or at least different, in CCAs than in the current survey area, lending support for such work.

During the earlier years of the survey, some of the sampling sites were fixed and some were random. The random-site component was abandoned in 2007 for reasons that seem quite sound to me – it simplified conducting the survey (no need to seek out new sites each year), the caution of “protecting” sampling sites from depletion as the survey visited them annually or from other fishers focusing on or avoiding them seemed to be unnecessary, and enhancing the statistical power of the survey results. Consequently, I see no reason to consider re-introducing a random-site component to the sampling.

I do, however, believe that the two experiments mentioned above can provide the team with better information as to just how representative the sampling sites truly are of the distribution, abundance, and biology of the target species within the entire SCB. Again, results from index area surveys can only be relied upon for assessments if the collection of index areas, as a whole, is representative of the area the assessment is attempting to describe. By excluding the deeper areas and the CCAs without at least examining the distribution of the target species within them, there is a real risk that the representativeness of the index areas may have been degraded. By experimentally examining the fish distributions and relative abundances in these adjacent areas, if possible, the team could adjust their findings as necessary or more confidently state that the index areas represent the SCB without considering adjustments for deeper waters or CCAs.

Some of the 20 sampling areas have very few sampling sites (single sites in each of Port Hueneme and 125 Fm Bank areas?) while others have many sites. It would seem that this would

pose analytical problems, particularly in areas with only 1 or 2 sites to sample. If so, the team should consider ways to add sites to those areas.

ToR 4: Evaluate the appropriateness of the gear used during the hook and line survey: rod and reel, mainline, gangion specifications, terminal tackle specifications, etc.

The sampling gear was thoughtfully and responsibly selected in consultation and cooperation with skippers from the recreational fishing fleet in the area. Choices reflect the knowledge of experienced fishers in the waters being sampled. While it is subject to the limitations of any form of passive sampling gear (requires the fish to attack the gear rather than being captured by the gear), it seems like an effective rig for sampling. Careful attention has been paid to standardizing the gear so that there should be minimal difference among individual rigs.

ToR 5: Evaluate the fishing and biological sampling protocols used during the hook and line survey.

The fishing protocols appear to be clear, effective, and well standardized. The effectiveness of the gear is apparent as each angler consistently catches several fish during each drop. Other than the two following minor points, I believe that the fishing protocols are good.

- One slight concern occurred to me during the discussion of the fishing protocols, however. The captains acknowledged that there is a range of fishing skill among their deckhand anglers and most anglers had a preferred fishing position along the rail (A:bow, B:midship, or C:stern). Anglers were allowed to choose their position (or sometimes skippers assigned them spots) without constraint. While their respective position along the rail is unlikely to make a difference in the overall catch characteristics of the site, it has the potential to impart some effect on the sampling. It seems to me that randomizing or rotating their positions at each drop would be a simple, cost-free means of accounting for this potential effect.
- I'm not sure whether or not I am concerned about this other point: whether to re-use an untaken bait or to rebait has not been standardized and the decision is left to the individual angler. During the discussion the skippers remarked that it depends on the fisherman – some rebait every time, others do not. Not being very familiar with the fine points about fresh vs used baits, I can't comment authoritatively on how I feel about this affect. The team should, however, at least consider standardizing this.

The biological sampling protocols appear to be thorough and well thought out. Careful documentation of a wide variety of events and environmental observations is made. Fish are

carefully marked and tracked as to drop number, angler position, and hook number. The positions of all anglers are documented on each drop. A comprehensive suite of biological information is collected from each fish which will enable thorough descriptions the biological characteristics of individual fish, as well as populations of each species.

ToR 6: Evaluate the methods and assumptions used to analyze the survey data as well as the associated uncertainty of the abundance estimates.

I have no experience in using models to analyze survey data so I will refrain from commenting on the nuts and bolts of the GLM model used to analyze the results of this survey.

While discussing features of the analysis, several areas of concern were raised by the review panel. Those that I consider to be important questions include the representativeness of the sampling sites and the effect of interspecific competition on the relative availability of each species to the sampling gear. I also agree with a couple of the suggestions discussed by the other reviewers involving clustering the results from sampling areas that exhibit similar results and parsimony when considering which variables to include in the models.

One of the primary assumptions of index type surveys is that the index sites are representative of the area for which you intend to estimate the abundance index. The selection of index sites for this area was carefully done in close cooperation with industry representatives with as much experience as anyone has. The objective was to make them representative. However the reviewers were presented no data to show just *how* representative these sites actually are of the rest of the region. While the site selection process that the survey team used seems like the right way to go about it, we are left with nothing but the team's assertion that the sites *are* representative of the population. It would be helpful for their case to look into some way of verifying this, although it would likely involve sampling in parts of the SCB that have heretofore been closed to sampling.

Interspecific competition for available survey hooks would quite likely confound or mask changes in the relative abundance among species. A notable increase in abundance for species A should result in more hooks being filled with that species. Consequently, fewer hooks would be available for species B to attack. If the population size of species B remained unchanged its apparent catch rate would be lower, leading one to think its population had declined. This effect could be further complicated by the different behavior patterns and foraging strategies among the target species. For example, bocaccio are generally more active, schooling fish than greenspotted rockfish, which is a more sedentary, benthic species. Also, bocaccio attack all 5 hooks of the sampling gear at about the same frequency, while greenspotted rockfish attack the hook closest to bottom most frequently and those above it progressively less frequently. Other differences in gear-attack behavior were noted, as well. All these characteristic behaviors have potential for confounding the survey's abundance signals. I haven't any suggestions about how

to resolve this concern, but it is something that the review panel was concerned about and ought to be considered by the analysts.

As I mentioned above, I don't feel confident or qualified to comment in depth on the finer points of the analytical methods. There were, however, two points that the other reviewers commented on that seem to me to make a lot of sense. One was the suggestion to "stratify" the 20 survey areas into clusters exhibiting similar catch characteristics using cluster analysis. This would likely result in 4 or 5 clusters and trends for each individual cluster could be derived. The second suggestion that made sense to me was to be more parsimonious about the variables that were selected for the model. Several of the variables being used were hard to explain in terms of their cause and effect. Excluding those that are difficult to explain would result in more simplified models that might be easier to interpret.

ToR 7: Evaluate the utility of hook and line survey data for species encountered consistently at a subset of sites, but for which the survey's coverage may be near the margins of their range (e.g., copper rockfish, widow rockfish, yellowtail rockfish) and other species we encounter episodically in each survey year (e.g., chilipepper). Identify modifications to the survey's design, protocols, or analyses which may improve the utility of survey data for stock assessments of additional species.

I should think that the utility of this survey for assessing less consistently caught species in the SCB would be fairly limited. The most valuable data for these species would likely be the biological data. The abundance data, particularly for those species appearing episodically, would be hard to interpret, particularly in light of concerns about the effect of interspecific competition mentioned above (under ToR 6). This would probably also be true for species near the margins of their range, since their ranges would likely expand and contract as their population size fluctuates and that would be notice more at the margins of their ranges. Even with the target species list limited to the present three species, there exists potential for interspecific competition masking abundance trends. I probably would not rely on the survey to assess less commonly caught species.

ToR 8: Potential survey expansion and other possible enhancements or modifications to the survey which could lead to additional objectives

- *Does the current design lend itself to expansion?*
- *Evaluate whether expanding the survey's sampling area would yield information useful for the assessment of structure associated rockfish.*

- *What are the scientific benefits and drawbacks of expanding the survey into adjacent areas currently not included in the survey area such as north of Pt. Conception or into the Cowcod Conservation Areas?*
- *Would the methods used by this survey be effective for collecting data and generating abundance indices for other structure-associated rockfish with high commercial or recreational importance elsewhere along the coast (e.g., yelloweye rockfish off the WA or OR coast?).*

One of the primary reasons that this survey was initiated was that the less trawlable substrate in the SCB. The hook and line gear and survey were chosen to enable sampling where trawl surveys weren't able to do the job adequately. Many areas of the coast north of Pt. Conception contain much higher proportion of trawlable habitat than in the SCB and have been surveyed relatively successfully for many years with trawl surveys. Hence, there is less of a need to expand this survey into these waters. There are, however, some less-trawlable areas and untrawlable areas that might benefit from expansions of the hook and line survey (Big Sur coast, Cape Mendocino, Heceta Bank, Cape Flattery, etc.). Such smaller areas would be good candidates for this type of survey if stock assessors believe that determining abundance of hookable species is important therein. This brings up another important point about hook and line surveys – they can only be reliably applied to species which will attack the gear. This effectively limits the application to large, piscivorous fish that live close to the bottom. Many species of large rockfish will, of course, be appropriate targets for this type of survey. However, when many species reside together in a relatively small area the interspecific competition issue could become problematic. This possibility should be considered when entertaining the expansion of this type of survey into any specific area. Within these limitations, however, I see no reason that this type of survey could not feasibly and productively be applied to areas further north along the coast to answer specific questions about the distribution, relative abundance, and population biology of important commercial or recreational species.

I commented on the likely usefulness of expanding this survey into Cowcod Conservation Areas above under ToR 3. Since the best minds in the business believe that there is a notable (significant?) difference in the relative abundance and/or population size composition of target species within vs outside the CCAs, either experimental or “production” application of this survey method in CCAs in the SCB are very likely to yield important information about the SCB populations as a whole. I strongly advocate this expansion, as well as an expansion into deeper water, as long as it is practicable in terms of sampling gear effectiveness.

Summary of conclusions and recommendations

Please refer to the Executive Summary section of the report above for my conclusions and recommendations.

Appendix 1: Bibliography of materials provided for review

Agency reports

Dick, E.J., D. Pearson and S. Ralston. 2011. Status of Greenspotted Rockfish, *Sebastes chlorostictus*, in U.S. waters off California. Pacific Fishery Management Council Stock Assessment and Fishery Evaluation.

Field, J.C., E.J. Dick, D. Pearson and A.D. MacCall. 2009. Status of bocaccio, *Sebastes paucispinis*, in the Conception, Monterey and Eureka INPFC areas for 2009. Pacific Fishery Management Council Stock Assessment and Fishery Evaluation.

Field, J.C., E.J. Dick, D. Pearson and A.D. MacCall. 2011. Status of bocaccio, *Sebastes paucispinis*, in the Conception, Monterey and Eureka INPFC areas as evaluated for 2011. Pacific Fishery Management Council Stock Assessment and Fishery Evaluation.

Harms, J.H., J.A. Benante, and R.M. Barnhart. 2008. The 2004–2007 hook and line survey of shelf rockfish in the Southern California Bight: Estimates of distribution, abundance, and length composition. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-95, 110 p.

Lea, R.N., R. D. McAllister and D.A. VenTresca. 1999. Biological Aspects of Nearshore Rockfishes of the Genus *Sebastes* from Central California With Notes On Ecologically Related Sport Fishes. Fish Bulletin 177.

Love, M.S., P. Morris, M. McCrae, and R. Collins. 1990. Life history aspects of 19 rockfish species (*Scorpaenidae: Sebastes*) from the Southern California Bight. NOAA Tech. Rep. NMFS 87, 38 p.

MacCall, A. D. 2002. Status of bocaccio off California in 2002. In: Status of the Pacific Coast Groundfish Fishery Through 2002 Stock Assessment and Fishery Evaluation Vol 1. Pacific Fishery Management Council.

MacCall, A.D. 2005. Assessment of Vermilion Rockfish in Southern and Northern California.

Research and Data Needs 2000-2002. Pacific Fishery Management Council.

Research and Data Needs 2008. Pacific Fishery Management Council.

Sakuma, K. M., S. Ralston, and V. G. Wespestad. 2006. Interannual and spatial variation in young-of-the-year rockfish, *Sebastes spp.*: expanding and coordinating the sampling frame. CalCOFI Reports 47: 127-139.

Stewart, I.J., J.R. Wallace and C. McGilliard. 2009. Status of the U.S. yelloweye rockfish resource in 2009.

Journal Articles

Harms, J.H., J.R. Wallace, I.J. Stewart. 2010. A fishery-independent estimate of recent population trend for an overfished U.S. West Coast groundfish species, bocaccio rockfish (*Sebastes paucispinis*). Fisheries Research 106: 298-309.

Hyde, J.R., Kimbrell, C.A., Budrick, J.E., Lynn, E.A., Vetter, R.D., 2008. Cryptic speciation in the vermillion rockfish (*Sebastes miniatus*) and the role of bathymetry in the speciation process. Mol. Ecol. 17, 1122–1136.

Appendix 2: A copy of the CIE Statement of Work

(I did not receive a copy of the CIE Statement of Work, since I was not a CIE reviewer. I have attached a copy that was given me by one of the CIE reviewers for my information. ~MEW~)

Attachment A: Statement of Work for Dr. Noel Cadigan

External Independent Peer Review by the Center for Independent Experts

NWFSC Southern California Shelf Rockfish Hook and Line Survey

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance with the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in Annex 1. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: The Northwest Fisheries Science Center's (NWFSC) Southern California Shelf Rockfish Hook and Line Survey was designed to collect fishery-independent data for use in the stock assessments of groundfish associated with rocky habitats that are not well-sampled using trawl surveys. Survey data are analyzed to generate annual indices of relative abundance and time series of biological data for several species of shelf rockfish (Genus: *Sebastes*) including bocaccio (*S. paucispinis*) – a species declared overfished by the Pacific Fishery Management Council (PFMC) and NOAA Fisheries and designated as a species of concern by NOAA Fisheries.

Hook and line survey data are also used to calculate abundance indices for several other species of shelf rockfish, and in some cases may be the only fishery-independent data available for use in stock assessments for those species. In addition to bocaccio, an abundance index and biological data from this survey have been incorporated into the Southwest Fisheries Science Center (SWFSC) 2011 stock assessment for greenspotted rockfish (*S. chlorostictus*). Abundance indices have also been calculated for starry rockfish (*S. constellatus*), speckled rockfish (*S. ovalis*), vermilion rockfish (*S. miniatus*) and its recently-delineated cryptic pair, sunset rockfish (*S. crocotulus*). A stock assessment for vermilion rockfish was conducted by the SWFSC in 2005; however its results were not endorsed by the PFMC's Science and Statistical Committee

for use in management in part due to newly-identified evidence of a cryptic species pair within the vermilion rockfish complex. Because this survey collects genetic information from all captured individuals, it is possible to generate separate abundance indices and biological data profiles for both vermilion and sunset rockfish retrospectively from the survey's start in 2004. This information may be helpful for re-visiting the stock assessment process for vermilion rockfish (and/or initiating the process for sunset rockfish.)

The overall goal of this review is to evaluate whether the design, protocols, and analytical methods developed for the NWFSC's hook and line survey are suitable for achieving the survey's objectives. The specific goals of the proposed review meeting are to: 1) evaluate the hook and line survey's design and protocols; 2) examine the analytical methods used to generate abundance indices; and, 3) provide suggestions regarding potential expansion of the survey's geographical range and species for which abundance indices are generated - particularly for data-poor and data-limited species. The Terms of Reference (ToRs) of the peer review are attached in Annex 2. The tentative agenda of the panel review meeting is attached in Annex 3.

Requirements for CIE Reviewers: Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have working knowledge and recent experience in the application of fish population dynamics, stock assessment methods, and fishery survey design. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Seattle, Washington tentatively during April 4-5, 2012.

Statement of Tasks: Each CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at

least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: <http://deemedexports.noaa.gov/sponsor.html>).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. Modifications to the SoW and ToRs cannot be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator. Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the Schedule of Milestones and Deliverables.

1. Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2. Participate in the panel review meeting in Seattle, Washington during April 4-5, 2012.

3. In Seattle, Washington during April 4-5, 2012 as specified herein, conduct an independent peer review in accordance with the ToRs (Annex 2).

4. No later than 20 April 2012, each CIE reviewer shall submit an independent peer review report addressed to the “Center for Independent Experts,” and sent to Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to David Die ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in Annex 2.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

5 March 2012	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
21 March 2012	NMFS Project Contact sends the CIE Reviewers the pre-review documents
4-5 April 2012	Each reviewer participates and conducts an independent peer review during the panel review meeting
20 April 2012	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
4 May 2012	CIE submits CIE independent peer review reports to the COTR
11 May 2012	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: This ‘Time and Materials’ task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council’s SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on changes. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:

- (1) each CIE report shall be completed with the format and content in accordance with Annex 1,
- (2) each CIE report shall address each ToR as specified in Annex 2,
- (3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:

William Michaels, Program Manager, COTR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-427-8155

Manoj Shivilani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
Northern Taiga Ventures, Inc. (NTVI)
22375 Broderick Drive, Suite 215, Sterling, VA 20166
RPeretti@ntvifederal.com Phone: 571-223-7717

Key Personnel:

Stacey Miller
NMFS Northwest Fisheries Science Center (NWFSC)
2032 SE OSU Drive, Newport OR 97365
Stacey.Miller@noaa.gov Phone: 541-961-8475

John Harms
NMFS Northwest Fisheries Science Center (NWFSC)
2725 Montlake Blvd. E, Seattle WA 98112
John.Harms@noaa.gov Phone: 206-860-3414

Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.

d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

Appendix 1: Bibliography of materials provided for review

Appendix 2: A copy of the CIE Statement of Work

Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Tentative Terms of Reference for the Peer Review

2012 NWFSC Southern California Shelf Rockfish Hook and Line Survey

- The overall goal of this review is to evaluate whether the design, protocols, and analytical methods developed for the NWFSC's hook and line survey are suitable for achieving the survey's objectives. The survey's primary objective is to generate information for use in stock assessments of structure-associated rockfish, particularly those species which are poorly sampled by trawl gear used in coast-wide surveys. Such information includes fishery-independent indices of abundance as well as biological data on size, age and maturity.
- Review recent literature (to be provided as background materials) to become familiar with the key species and the primary science and management issues within the Pacific Fishery Management Council (PFMC) umbrella for groundfish in general and structure-associated shelf rockfish in particular.
- Evaluate the suitability of the survey sampling design. Specifically, is the design appropriate for generating abundance indices for shelf rockfish species?
 - Comment on the benefits and drawbacks of the current fixed-site design. Are there benefits to replace or modify the survey's existing fixed-site design with one that includes a random component? If so, do the benefits outweigh the drawbacks associated with disrupting the continuity of the survey's current 8-year time series?
- Evaluate the appropriateness of the gear used during the hook and line survey: rod and reel, mainline, gangion specifications, terminal tackle specifications, etc.
- Evaluate the fishing and biological sampling protocols used during the hook and line survey
- Evaluate the methods and assumptions used to analyze the survey data as well as the associated uncertainty of the abundance estimates.
- Evaluate the utility of hook and line survey data for species encountered consistently at a subset of sites, but for which the survey's coverage may be near the margins of their range (e.g., copper rockfish, widow rockfish, yellowtail rockfish) and other species we encounter episodically in each survey year (e.g, chilipepper). Identify modifications to the survey's design, protocols, or analyses which may improve the utility of survey data for stock assessments of additional species.
- Potential survey expansion and other possible enhancements or modifications to the survey which could lead to additional objectives

- Does the current design lend itself to expansion?
- Evaluate whether expanding the survey's sampling area would yield information useful for the assessment of structure associated rockfish
- What are the scientific benefits and drawbacks of expanding the survey into adjacent areas currently not included in the survey area such as north of Pt. Conception or into the Cowcod Conservation Areas?
 - Would the methods used by this survey be effective for collecting data and generating abundance indices for other structure-associated rockfish with high commercial or recreational importance elsewhere along the coast (e.g., yelloweye rockfish off the WA or OR coast?)
- Final panel report
 - The report will be divided into sections corresponding to design, protocols, analysis, and survey expansion. Each section should contain the reviewers' understanding of the survey's objectives for that component, followed by analysis and commentary, strengths/weaknesses, and recommended changes/modifications (if any). We also request a prioritization of recommended changes and an evaluation of the potential repercussions if the recommendations cannot be implemented due to budget constraints.
 -

Annex 3: Tentative Agenda

2012 Hook & Line Survey Review Panel Meeting

Seattle, Washington

Wednesday, April 4, 2012

- 8:00-8:30: Welcome, Introductions, and Objectives of the Review Panel
- 8:30-9:45: Presentation on Survey Background, Rationale, Objectives, and Design
- 9:45-10:30: Presentation on Survey Operations and Sampling Protocols
- 10:30-10:45: Break
- 10:45-12:00: Discussion of Presented Material

12:00-1:15: Lunch

1:15-2:00: Presentation on Analytical Methods

2:00-3:00: Discussion of Analytical Methods

- Basic approach
- Model selection

3:00-3:15: Break

3:30-4:30: Continued Discussion of Analytical Methods

- Variance estimation
- Power analysis

4:30: Meeting ends for the day.

Thursday, April 5, 2012

8:00-8:15: Re-cap of Yesterday's Discussion

8:30-10:15: Continued Discussion on Analytical Methods and all Presented Material

10:30-10:45: Break

10:15-11:00: Presentation on Potential Survey Expansion

11:00-12:00: Discussion of Potential Survey Expansion

12:00-1:15: Lunch

1:15-2:00: Continued Discussion of Potential Survey Expansion

2:00-3:00: Additional Discussion (Open Topic; as Necessary)

3:00-3:30: Instruction to Panel on Final Reports

3:30pm: Meeting Adjourns

Appendix 3: Panel Membership or other pertinent information from the panel review meeting

Appendix 3: Panel Membership

Review Panel

Chair: Mark Wilkins, AFSC (ret.)

Noel Cadigan (CIE)

Sven Kupschus (CIE)

Hook & Line Survey Team

Matt Barnhart (PSMFC/NWFSC)

Jim Benante (PSMFC/NWFSC)

John Harms (NOAA/NWFSC)

Ian Stewart (NOAA/NWFSC)

John Wallace (NOAA/NWFSC)

Other Participants

Aimee Keller (NOAA/NWFSC)

Patty Burke (NOAA/NWFSC)

Michelle McClure (NOAA/NWFSC)

Capt. Joe Villareal (F/V Mirage)

Capt. Mike Thompson (F/V Aggressor)